

Control of Infectious Diseases in Drinking Water



Morgan State University
Baltimore, MD
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Steve Clarke, P.E.

U.S. Army Center for Health Promotion and Preventive Medicine
Water Supply Management Program



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Overview

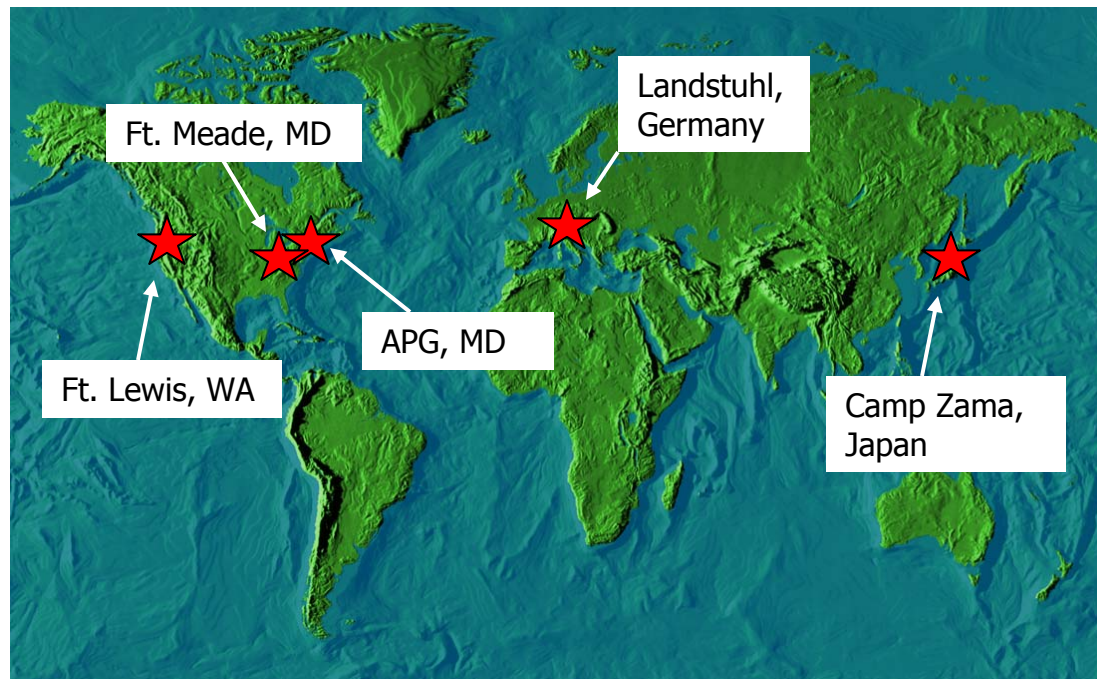
- Introduction
- Pathogen Control
 - Source
 - Treatment
 - Distribution
 - Regulation
 - Water System Security
- Army Experience
- Wrap-up

RAINDROP TO TAP
INTEGRATED APPROACH FOR
ENSURING QUALITY DRINKING WATER

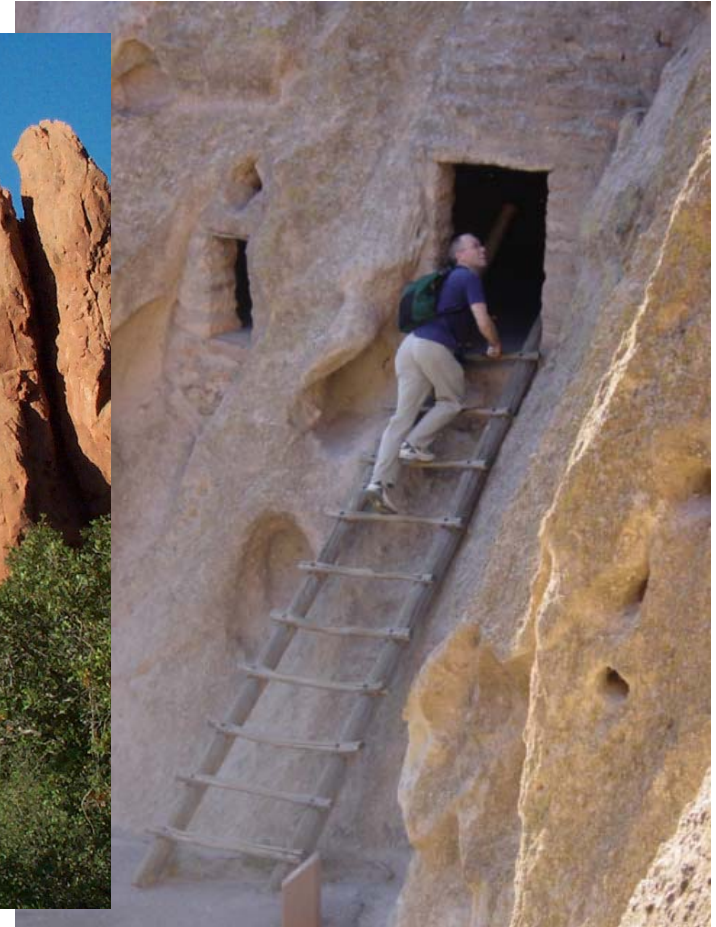


Introduction

- The U.S. Army Center for Health Promotion and Preventive Medicine
- Water Supply Management Program



Introduction



Introduction



Introduction



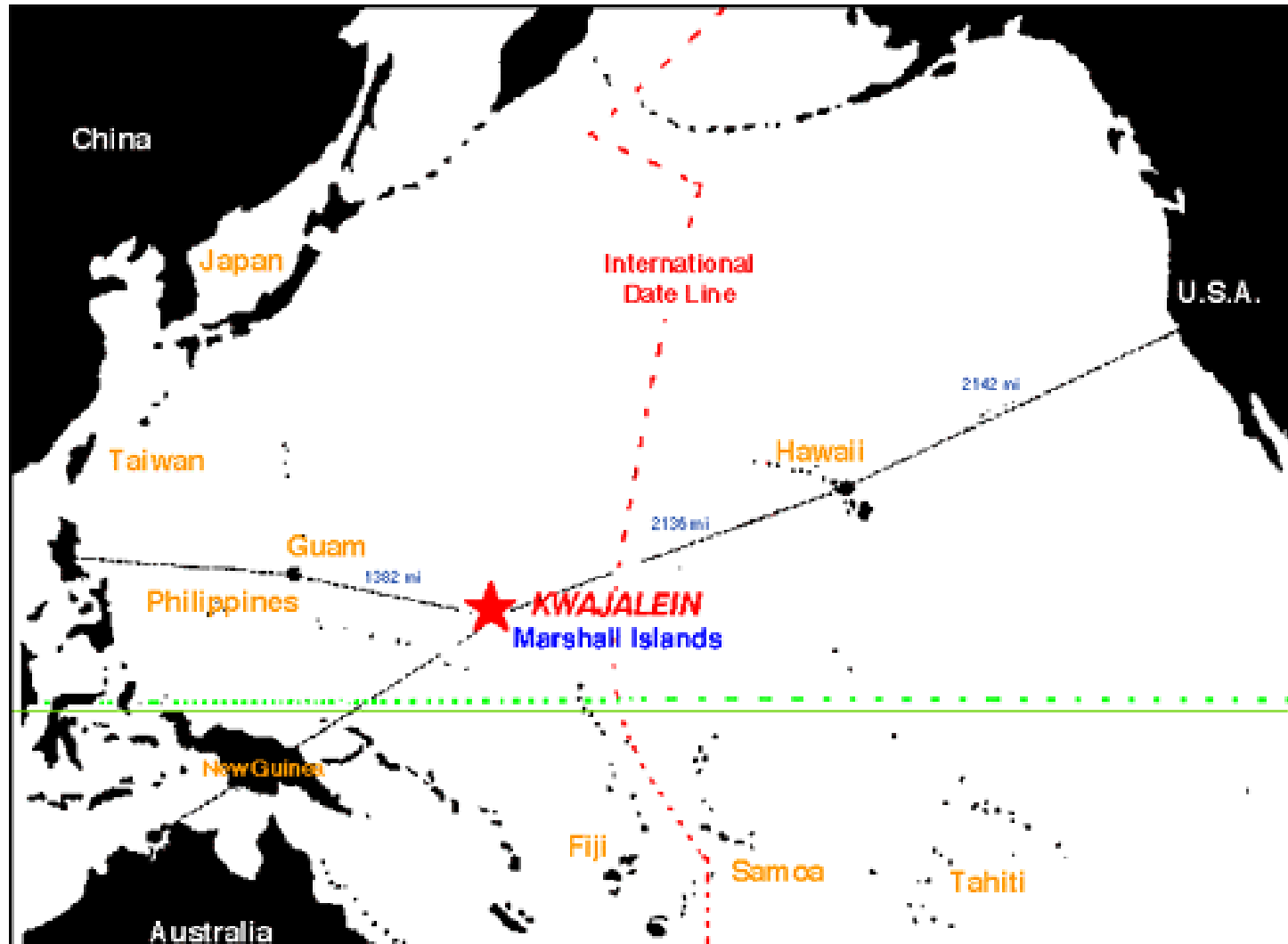
Introduction



Introduction



Introduction



Introduction

- Cholera outbreak Dec 2000
 - Ebeye Island
 - 103 defined cholera cases
 - 6 deaths
 - U.S. Army water system suspected



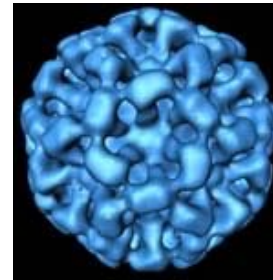
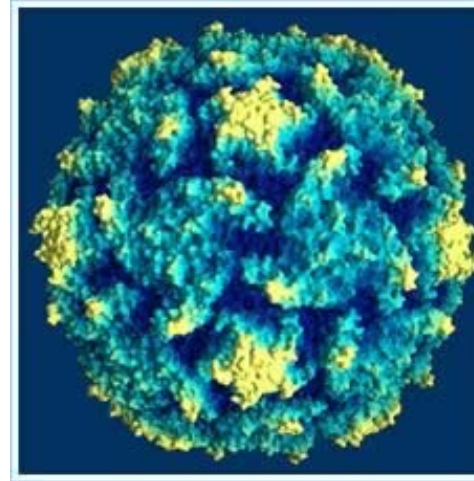
Introduction

- Suspected mode of transmission
 - Underlying causes of outbreak
 - Outbreak termination

 - Drink mixes may protect against cholera
 - Reference:
 - Clinical Infectious Diseases, Vol. 38, Jan 2004, pp. 1-9.
-

Pathogen Control

- Source Protection
- Treatment
 - Filtration
 - Disinfection
- Distribution Protection
- Regulatory Drivers
- Water System Security



Pathogen Control – Source

- Surface Water
 - Access control
 - Contaminant inventory
 - Wastewater discharge regulations
 - Intake location
- Groundwater
 - Well construction
 - Contaminant inventory
 - Delineate well recharge area

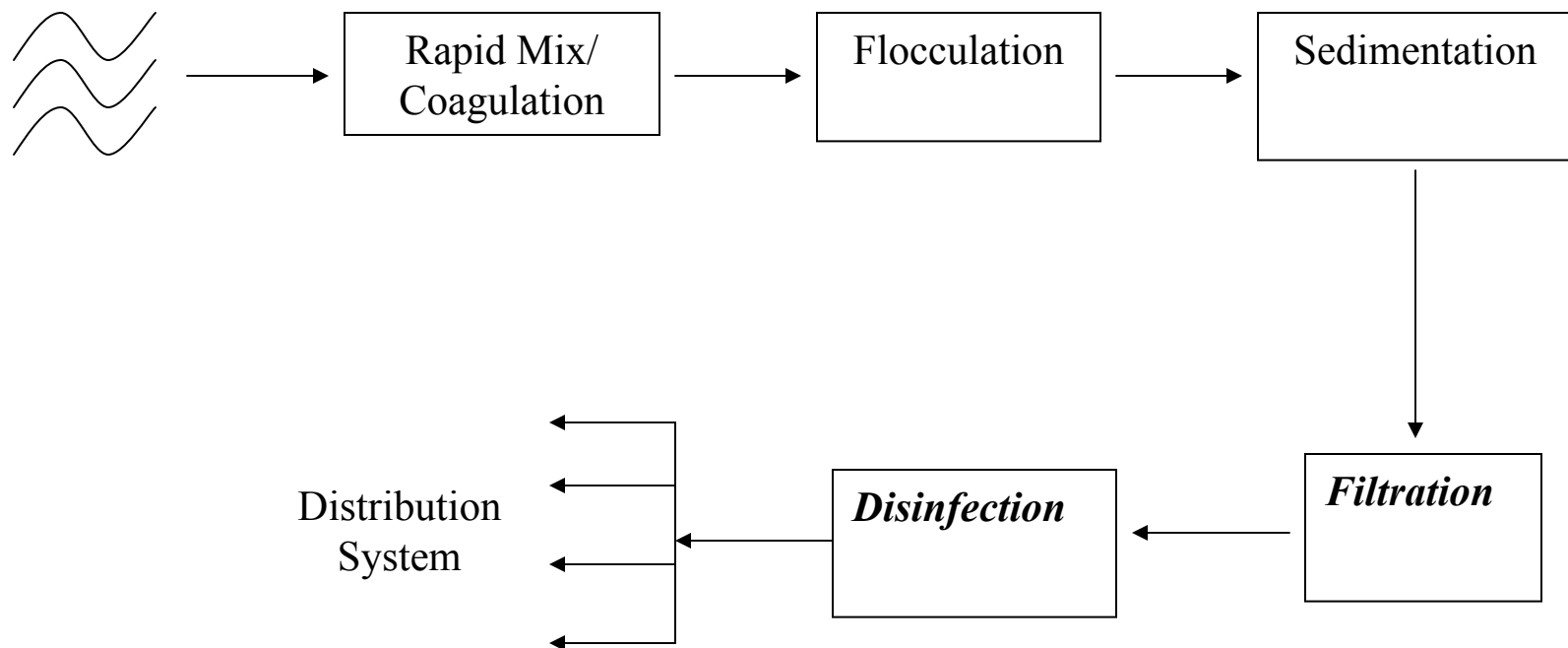


Pathogen Control - Treatment

- Physical Removal
 - Chemical coagulation, flocculation, sedimentation, and ***filtration***
- Inactivation/Destruction
 - ***Disinfection***

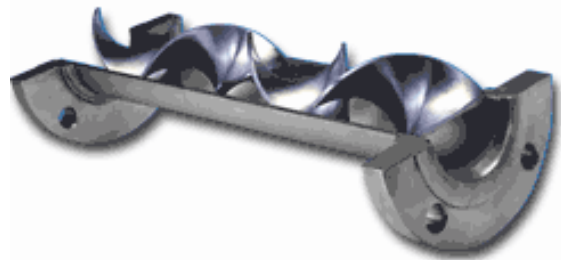
LIFE: Filtration and disinfection of drinking water is “probably the most significant public health advance of the millenium”

Pathogen Control - Treatment

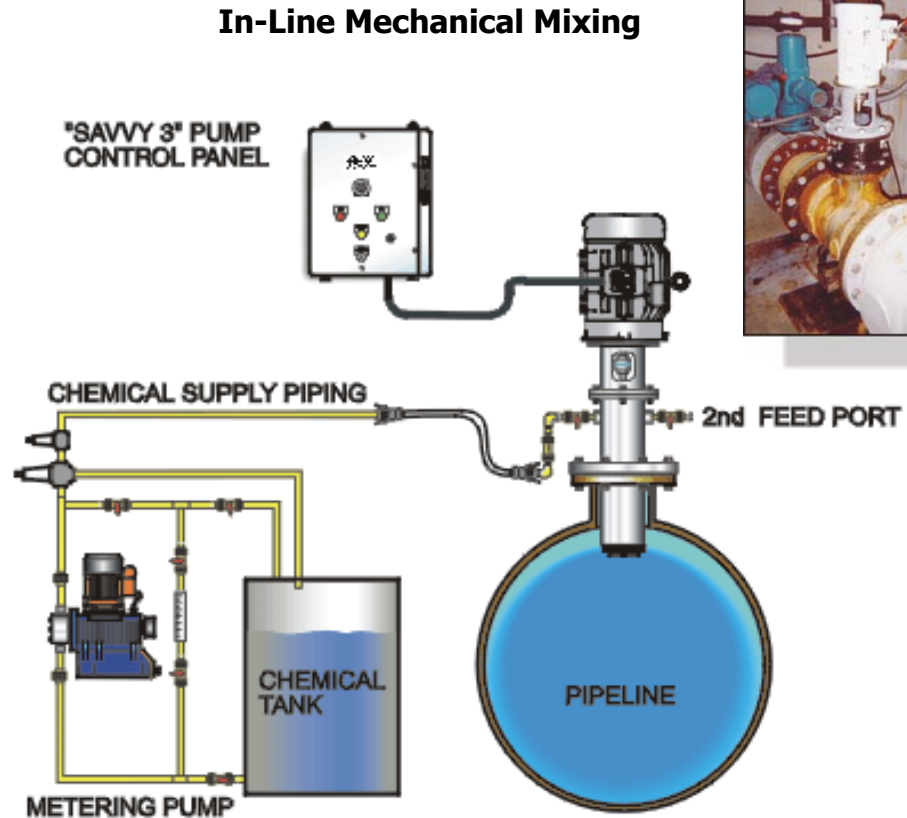


Pathogen Control - Treatment

- Coagulation



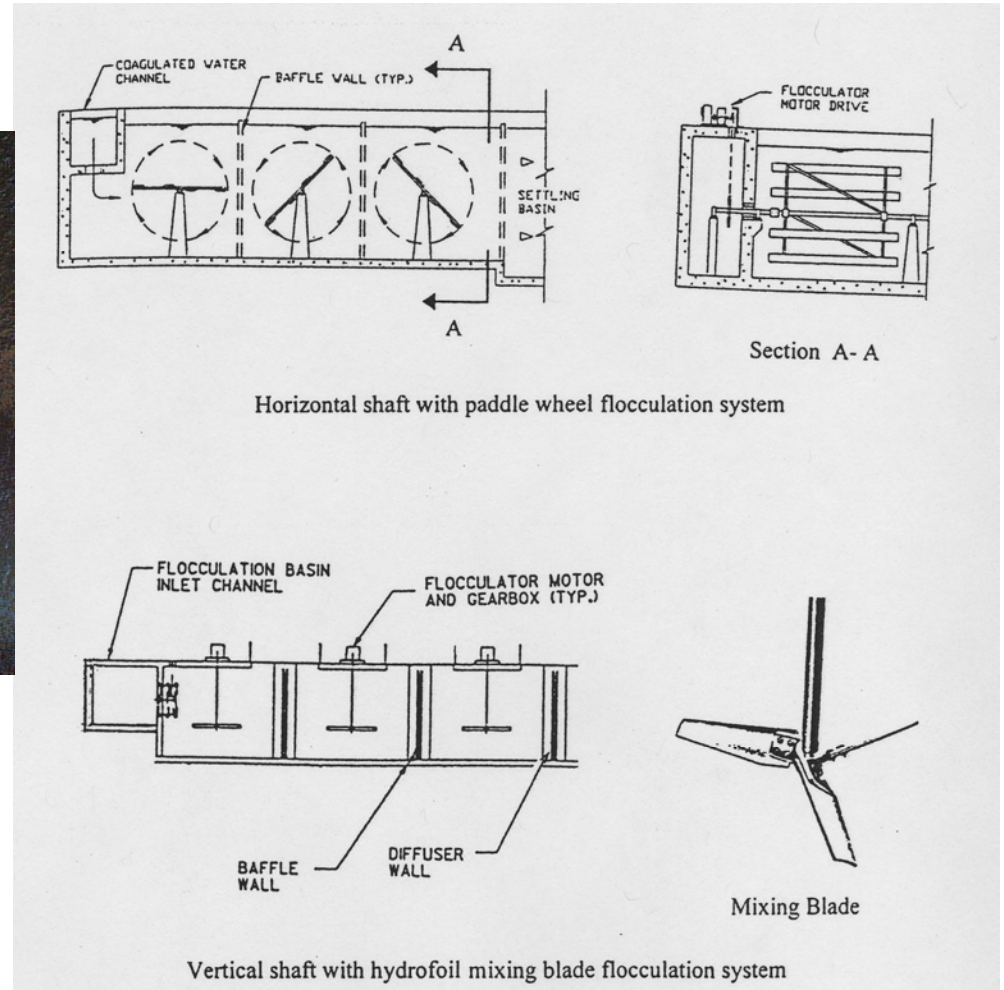
In-Line Static Mixing



Source: www.mastrrr.com

Pathogen Control - Treatment

- Flocculation



Source: Kawamura, S., Integrated Design and Operation of Water Treatment Facilities, 2nd ed., Wiley, NY, 2000.

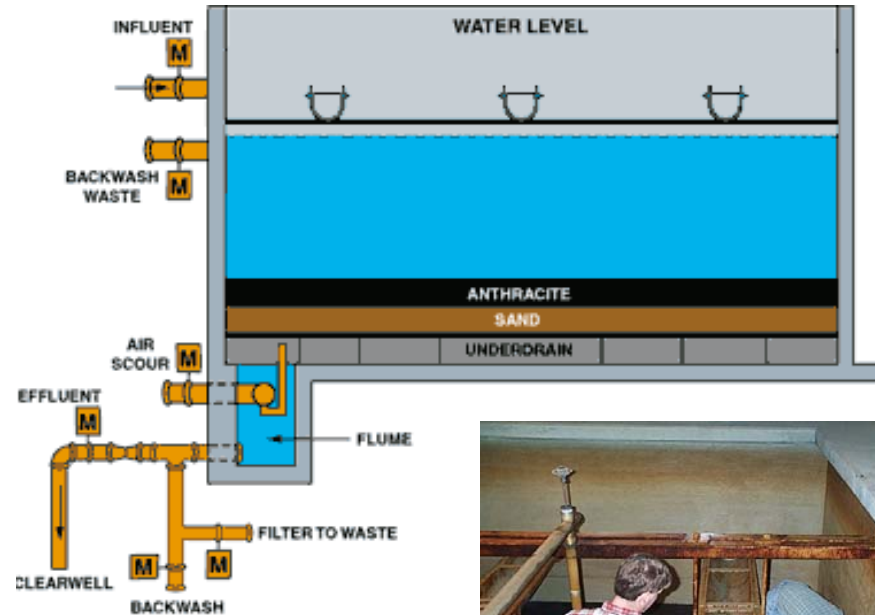
Pathogen Control - Treatment

- Sedimentation



Pathogen Control - Treatment

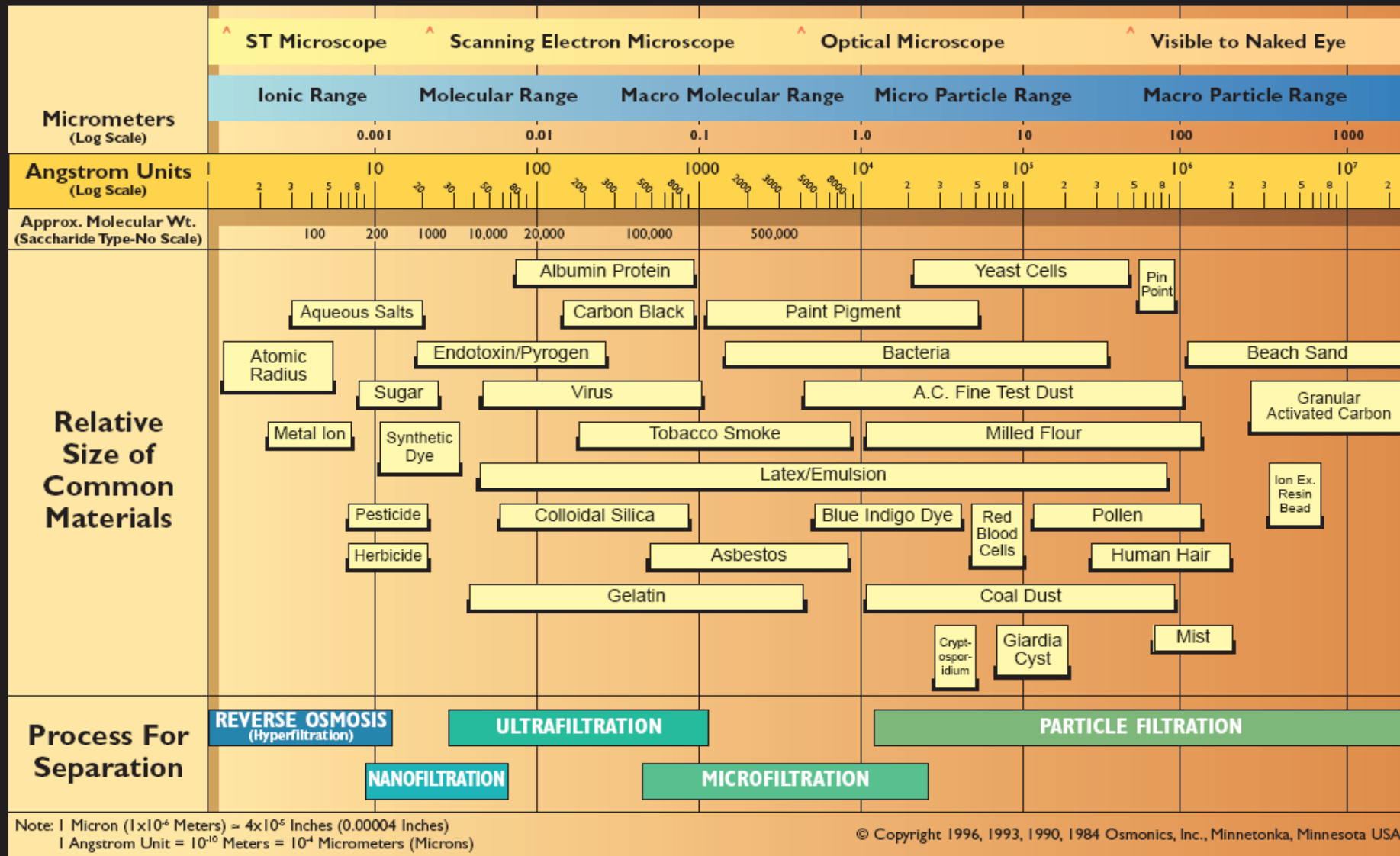
- Filtration
 - Slow rate
 - Rapid rate
 - Membrane





OSMONICS

The Filtration Spectrum



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Osmonics, Inc.
 Corporate Headquarters
 5951 Clearwater Drive • Minnetonka, Minnesota 55343-8990 USA
 Toll Free: 800/848-1750 Fax: 612/933-0141

Osmonics Asia/Pacific, Ltd.
 Bangkok, Thailand Fax: 011-66-2-39-18183
 Tokyo, Japan Fax: 011-81-48-622-6309

Osmonics Europa, S.A.
 LeMee Sur Seine (Paris), France
 Fax: 011-331-64-37-9211

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Pathogen Control - Treatment

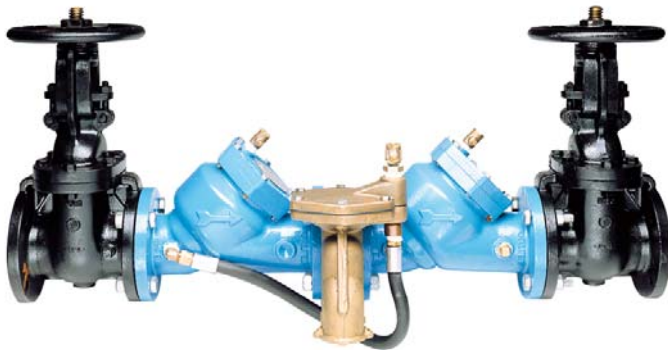
- Disinfection
 - Chlorination
 - Chloramination
 - Chlorine dioxide
 - Ozone
 - Ultraviolet irradiation (UV)
-

Pathogen Control - Treatment



Pathogen Control - Distribution

- Backflow/backsiphonage protection



Pathogen Control - Distribution

- Storage tank O&M



- Flushing



Pathogen Control - Regulations

- Source protection
 - Source Water Assessment & Protection Program (SWAPP)
 - Wellhead Protection Program (WHPP)
 - Sole Source Aquifer Program (SSA)

Pathogen Control - Regulations

- Treatment & distribution
 - Total Coliform Rule (TCR)
 - Fecal contamination
 - Surface Water Treatment Rule (SWTR)
 - *Giardia*, *Legionella*, viruses
 - Interim Enhanced SWTR/Long-term 1 Enhanced SWTR (LT1ESWTR)
 - *Cryptosporidium*
 - LT2ESWTR
 - *Cryptosporidium*
-

Pathogen Control - Security

- Intentional biological contamination
 - Distribution system vulnerability
 - Hydrants
 - Residences
 - Storage tanks
 - Contaminants of concern
 - *Anthrax bacillus*
 - Botulinum toxin
 - *Cryptosporidium*
-

Pathogen Control - Security

- Fort Bliss, TX DEC 2003
- Two storage tanks discovered tampered during routine annual inspections



Army Experiences

- Army water system-related contamination events
 - Mycobacterium in hospital water supply
 - *Legionella* in building hot water supplies
 - Norwalk virus (suspected)
 - *E.coli* contamination without increased illnesses
-

Wrap-Up

QUESTIONS?

